Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_

**Lactose Intolerance**

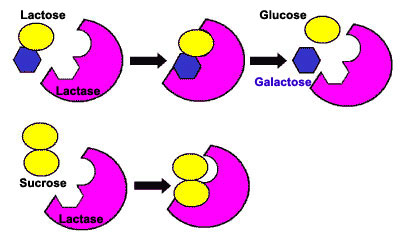
Kendra was so embarrassed! About an hour after chowing down on pizza and ice cream with a group of friends, her stomach suddenly started rumbling, and she started farting. Then Kendra's stomach began to ache and she had to run to the restroom every few minutes. In the excitement of an afternoon hanging out at the mall, Kendra had forgotten to watch her dairy intake.

Kendra has lactose intolerance and her symptoms flare up when she eats more dairy than her body can handle.

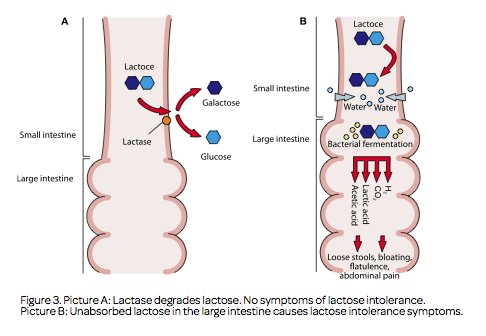
**What Is Lactose Intolerance and What Causes It?**

Lactose intolerance is the inability to digest a sugar called **lactose** that is found in milk and dairy products.

Normally when a person eats something containing lactose, an enzyme in the small intestine called **lactase** breaks down lactose into simpler sugar forms called **glucose** and **galactose**. These simple sugars are then easily absorbed into the bloodstream and turned into energy — fuel for our bodies.



People with lactose intolerance do not produce enough of the lactase enzyme to break down lactose. Instead, undigested lactose moves into the large intestine and gets fermented (broken down) by bacteria, causing gas, bloating, stomach cramps, and diarrhea.



1. **A. Lactase present**. In the small intestine lactase breaks down lactose into galactose and glucose which are absorbed into the bloodstream to be distributed to cells throughout the body.
2. **B. Lactase absent**. Unprocessed lactose moves to the small intestine where it is fermented by bacteria causing gas, bloating, etc.

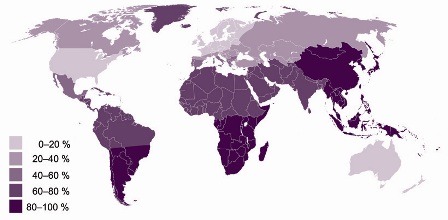
**Who Gets Lactose Intolerance?**

Lactose intolerance is fairly common. It seems to affect guys and girls equally. Some ethnic groups are more likely to be affected than others because their diets traditionally include fewer dairy products: Almost all Asians and Native Americans are lactose intolerant, and up to 80% of African Americans and Hispanic Americans also have symptoms of lactose intolerance. Their ancestors did not eat dairy foods, so their bodies were not prepared to digest dairy, and they passed these genes on from generation to generation.

A person may be or may become lactose intolerant for different reasons:

* **Age.** Normally, your body produces large amounts of lactase at birth and during early childhood, when milk is the primary source of nutrition. Usually your lactase production decreases as your diet becomes more varied and less reliant on milk. Many people will naturally become lactose intolerant over time.
* **Ethnic background.** People of Asian, African, Native American, and Hispanic backgrounds are more likely to develop lactose intolerance at a young age.
* **Other problems with the digestive tract.** People who have inflammation of their upper small intestine, such as celiac or Crohn's disease, have a reduced level of the lactase enzyme.
* **Medications.** Certain antibiotics can trigger temporary lactose intolerance by interfering with the intestine's ability to produce the lactase enzyme.
* **Infection.** After a bout of infectious diarrhea, some kids can develop a temporary lactose intolerance that usually improves after a few days or weeks.

Worldwide Frequency of Lactose Intolerance



**How Do Doctors Diagnose It?**

If your doctor suspects you might be lactose intolerant, he or she will take your **medical history** by asking about any concerns and symptoms you have, your past health, your family's health, any medications you're taking, any allergies you may have, and other issues. Your doctor will also perform a **physical examination**.

Doctors can test for lactose intolerance by using the hydrogen breath test. Normally very little hydrogen gas is detectable in the breath. However, undigested lactose in the colon ferments (breaks down) and produces various gases, including hydrogen.

If your doctor decides to give you a hydrogen breath test, you'll be asked to blow into a tube for a beginning sample. You'll then swallow a drink with lactose in it, wait a while, and breathe into the tube again. You'll be asked to blow into the tube every half hour for 2 hours in order to measure hydrogen levels in your breath. The levels should go up over time if you have lactose intolerance.

Doctors also can find out if you're able to digest lactose by testing for the presence of lactase with an **endoscopy**. During this procedure, doctors view the inside of the intestines by inserting a long tube with a light and a tiny camera on the end into the mouth.

A doctor can then take tissue samples and pictures of the inside of your gut and look for clues to why you've been having problems with what you're eating. The amount of lactase enzyme can be measured in one of these tissue samples.

**Living With Lactose Intolerance**

Lactose intolerance is a very individual condition and it's often easy to manage if you're in tune with your body. Everyone's different, but most people with lactose intolerance are able to eat a small amount of dairy. The trick is to eat dairy products in combination with other foods that don't contain lactose and not eat too much dairy at once. It can also help to keep a food diary to learn which foods your body can or can't tolerate.

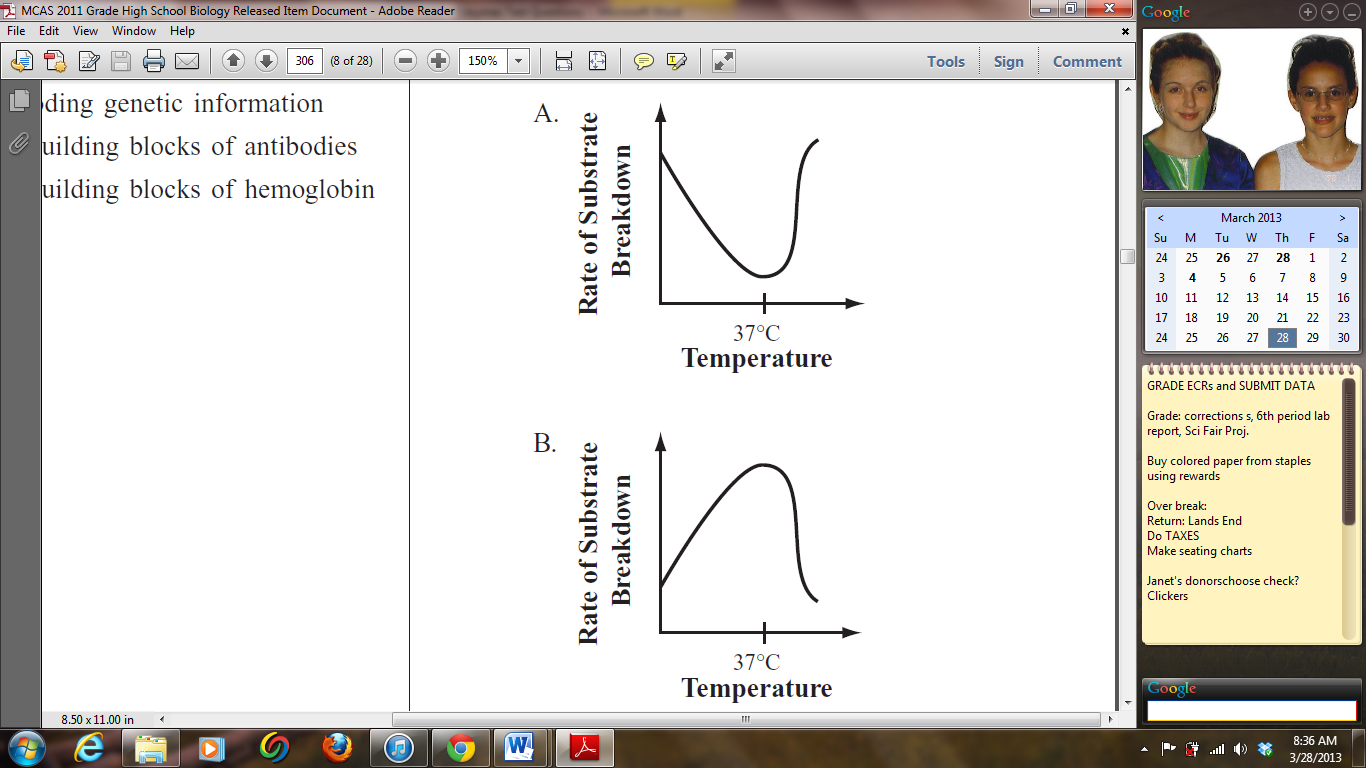
Dairy foods are the best source of calcium, a mineral that's important for bone growth. Because growing teens need about 1,300 milligrams (mg) of calcium each day, the American Academy of Pediatrics (AAP) recommends that even teens who have lactose intolerance continue to include some dairy in their diet.

Foods like cheese or yogurt may be easier to digest than milk, so try a cup of yogurt for dessert or add a piece of cheese to your sandwich. Lactose-free milk is also a great way to get calcium in your diet without the problems that can come with lactose.

Taking a lactase enzyme supplement might help, too. Taking this before eating foods that contain dairy will help the body digest the lactose sugar in dairy so you don't develop the symptoms of lactose intolerance, like pain, cramping, bloating, gas, and diarrhea.

Teens with the most severe symptoms of lactose intolerance might have to avoid all dairy products. It's extra important that these teens find other good calcium sources, so talking to a registered dietitian is a good idea. Dietitians are trained in nutrition and they can help people who are lactose intolerant come up with eating alternatives and develop a well-balanced diet that provides lots of calcium for developing strong bones.

**Questions**

1. What is lactose intolerance?
2. What is lactose?
3. What is lactase? What is the function of lactase?
4. What are some symptoms of lactose intolerance?
5. Why do many people develop lactose intolerance as they age?
6. Why are some ethnic groups more prone to lactose intolerance than other ethnic groups?
7. Why is a hydrogen breath test used to diagnose lactose intolerance?
8. How can people with lactose intolerance ensure they still get enough calcium?
9. The graph below shows how temperature affects pepsin, an enzyme, activity (measured by the rate of substrate breakdown. Complete the conclusion about the information given by the graph.

Pepsin activity increased until \_\_\_\_\_\_\_\_\_\_⁰ C. The optimum (best) temperature for pepsin is \_\_\_\_\_\_\_\_⁰ C. After the optimum temperature is reached pepsin activity \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

1. Create two line graphs. One showing the optimum (best) temperature for lactase is about 25 °C (77 °F) and one showing the optimum pH for lactase is 6. Be sure to label the x-axis. (You don’t have to put titles.)

Lactase activity

Lactase activity